Fermilab

Particle Physics Division
Mechanical Department Engineering Note

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Title: Auxiliary Beam Trolley Installation on the PAB overhead
             building crane in the high bay

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Reviewer(s):

Key Words: Crane beam loading, auxiliary trolley installations.

Abstract Summary: Because of limited vertical clearance available with the
main hook on the PAB high bay crane, a beam trolley will be installed on
the north cross beam (this is not the beam that the main trolley rides on) and
used to support a manual lifting device. This device will be used to lift and
install a unistrut frame assembly. The weight of the unistrut frame assembly
is approximately 100 pounds.

Applicable Codes: AISC 9th

The crane beam to which the beam trolley is attached is a W18 by 35.

<u>Check flange bending due to a point load.</u>

Moment is 300 inch pounds (assume one hundred pound load at the outermost tip of the flange, bf = 6 inches).

Assume this is taken by a 2 inch long by 7/16 inch thick portion of the flange. The moment of inertia, $I = 1/12*a\ b^3 = 1/12 * 2" * (7/16)^3 = 0.014$ in ^4,

Bending stress, Sigma, $= My/I = 300$ inch-pounds $* 7/32 / 0.014 = 4702$ psi.

Allowable bending stress is 0.6 * Fy. Fy = 36,000 psi, therefore the allowable bending stress is 21,600 psi. Since the allowable bending stress exceeds the actual bending stress, this is acceptable.

<u>Check beam loading due to the 100 pound additional load:</u>

Span of crane beam is 35 feet. Moment of inertial for the W18x35 is 510 in^4. Bending stress (assumes worst case loading of the beam at mid-span) of 100 pounds is $P*l/4 = 100$ pounds $* 35$ feet $* 12$ inches per foot $/ 4 = 10,500$ inch pounds. Bending stress is $My/I = 10500*9 / 510 = 185$ psi. This is a negligible load on the beam.

<u>Conclusion:</u>

The use of the beam trolley to lift this light load from the secondary crane beam put a negligible load on the crane and induces bending stresses well within acceptable limits.